VACUUM CLEANER HAVING A BLOWER CAPSULE

The invention relates to a vacuum cleaner according to the preamble of claim 1.

Known from DE 41 00 858 A1 is a vacuum cleaner comprising a blower unit which is surrounded by an inner housing capsule which for its part is built into an outer housing capsule leaving a flow space, and free space exists between said outer capsule and the housing. In this case, the air flow produced by the blower unit is guided through the flow space to an outlet provided on the housing. The blower unit is completely encapsulated by means of an inner cup-shaped capsule and an outer housing capsule surrounding this, which consists of two cup-shaped housing shells. The inner housing capsule is held in the outer housing capsule by means of profile rails moulded on an outer rail of the inner housing capsule. A disadvantage with this holding is that the inner housing capsule must be fixed in a separate assembly step on the outer housing capsule. This design not only requires an additional assembly step but the flow channel cannot be configured as largely smooth-walled in this case since the existing assembly gaps form perturbing edges for the air flow.

It is the object of the invention to provide a fluidically optimised flow channel between an insulating capsule of a motor/blower unit and a housing part using simple means which are inexpensive to produce and assemble. In addition, the assembly safety should be enhanced and assembly errors reduced.

According to the invention, this object is solved by at least one capsule part of an insulating capsule being joined in one piece to a housing part, especially a blower housing. As a result of the capsule part or insulating capsule and housing part or blower cover being joined in one piece, the flow channel is constructed more fluid-dynamically, especially since fewer assembly gaps are present and thus fewer perturbing edges are located in the flow channel. Assembly errors are reliably excluded since the exhaust channel is precisely fixedly attached and thus no assembly errors can occur. The assembly itself is simplified since a separate assembly step for fixing a separate capsule part is no longer required. In this case, the geometry of the flow channel can be specified particularly fluidically favourably without regard to otherwise necessary assembly and connecting means.

In a preferred embodiment of the invention, a first capsule part is moulded on the housing, especially on a lower shell of the vacuum cleaner. If a lower capsule part is already moulded on the lower shell of the vacuum cleaner housing, the motor/blower unit can be simply inserted into the lower shell without it being necessary to previously mount a capsule part on the motor/blower unit and without it being necessary to fix the pre-assembled structural unit separately in the vacuum cleaner housing. In particular, the number of parts is also reduced if the insulating capsule or capsule parts thereof and/or the blower housing or housing parts such as the blower cover for example are moulded directly on the vacuum cleaner housing part, preferably on the lower shell of the vacuum cleaner. This moulding-on of the parts can be favourably accomplished by plastic injection moulding.

Advantageously, the first capsule part can have inwardly directed capsule wall sections which start from the lower shell. As a result of the inwardly directed capsule wall sections, the motor/blower unit can be inserted simply and rapidly vertically from above into the lower shell whereby assembly can take place very rapidly. At the same time, the motor/blower unit is already surround in a sound-insulating fashion at the bottom and by the side walls of the capsule part. The surrounding of the motor/blower unit which takes place at five side walls is achieved without assembly gaps and thus without using additional sealing means. Any separate gaps via which sound could penetrate outwards could be largely avoided so that particularly good sound insulation is achieved.

Preferably at least one capsule wall section can have an opening which connects an interior space bounded by the insulating capsule to the duct. In this case, the overflow connection from the interior of the insulating capsule and the flow channel is already formed during manufacture so that no additional flow channel connections or similar connecting pieces need to be inserted separately and connected fluidically to the flow channel. The sealing problem is additionally dispensed with.

The housing part of the blower housing can be formed by a housing half, especially by the lower shell of the vacuum cleaner. It is especially advantageous if not only capsule parts of the insulating capsule but also housing parts such as, for example, the blower housing are constructed or moulded directly on the lower shell or an alternative other housing part of the vacuum cleaner. The number of parts is thus additionally reduced and the necessary dividing gap between individual housing parts is reduced. At the same time, the sealing expenditure is lower. If additional seals can be omitted, the vacuum cleaner can be manufactured more cheaply.

In a preferred embodiment, the housing part of the blower housing comprises a holder for receiving a bearing element for the motor/blower unit. In the same way, holders for the motor/blower unit can already be constructed or moulded on a component of the vacuum cleaner. Preferably, this will be the blower housing but the holder or holders for the motor/blower unit can also be attached or moulded, for example, directly on the lower shell or on a capsule part of the insulating capsule. The holder or a part of the holder can also be arranged at a dividing wall which runs between a dust collecting compartment and a blower compartment.

The holder is preferably constructed as a half-shell-shaped ledge which is open at the top and projects into the blower compartment. This makes it possible to simply and rapidly insert the motor/blower unit into the vacuum cleaner during manufacture since it is sufficient to merely insert the motor/blower unit from above into the housing part until the motor/blower unit rests on the half-shell-shaped holder. This substantially simplifies assembly.

In a preferred embodiment of the invention, the housing part of the blower housing is a blower compartment cover on which a second capsule part of the insulating capsule is formed. In addition to the parts of the insulating capsule or the blower housing preferably moulded on the lower shell of the vacuum cleaner, it is advantageous to provide only a single further component to mount the motor/blower unit in an insulating capsule in a blower compartment inside the vacuum cleaner housing. The number of parts is then restricted to the very minimum that is necessary. Only one single dividing plane is then present, this being necessary however to be able to insert the motor/blower unit into the cavity

formed. Only a single dividing gap to be sealed between these two components remains.

A main flow channel for a main air flow is arranged so that it runs between the blower compartment cover and the second capsule part. The main flow channel can be arranged so that it runs behind an end of the motor/blower unit opposite to a suction opening. At least one auxiliary flow channel for an auxiliary air flow can be arranged so that it runs between the blower compartment cover and the second capsule part. As a result of the position of the main flow channel, the main air flow can be supplied centrally to the motor/blower unit in the direction of the exhaust opening. If a plurality of auxiliary flow channels are provided, these can be connected to the main flow channel, being constructed as the same length. The same length of the auxiliary flow channels ensure that the turbulence effect at each intersection of auxiliary air flow and main air flow is at least approximately the same. A particularly effective turbulence is achieved by intersection of the flow directions of auxiliary air flow and main air flow. The intersection is preferably accomplished by perpendicularly impinging air flows. However the auxiliary air flow and main air flow can also intersect at a different angle, for example either at an acute angle to one another or even at an obtuse angle. The auxiliary air flow and main air flow could even be directed frontally to one another.

In each case, at least one auxiliary flow channel is arranged so that it runs at the side of the motor/blower unit. Preferably two auxiliary flow channels are provided which are arranged so that they run on opposite sides of the motor/blower unit. However, a plurality of respectively pair-wise auxiliary flow channels can also be arranged to that they run on opposite sides of the motor/blower unit, preferably discharging into a common main flow channel. The auxiliary flow channels preferably have a rectangular cross-section and extend substantially vertically. As a result of this arrangement, a good draught is obtained in the auxiliary flow channels and the housing part of the vacuum cleaner comprising the auxiliary flow channels can nevertheless be produced simply and cheaply.

In an advantageous variant, at least one auxiliary flow channel is fluidically connected to the main flow channel via at least one intake opening. The intake

opening can be constructed as a circular hole in a thin intermediate wall between auxiliary flow channel and main flow channel. A sharp-edged screen is thereby created in the area of the intake opening at which additional turbulence of the exhaust air takes place. In this case, the free opening cross-section of the intake opening can preferably be smaller than the flow cross-section in the remaining auxiliary flow channel.

In a preferred embodiment of the invention, the opening cross-section of the at least one intake opening is smaller than the flow cross section of the respective auxiliary flow channel. As a result, a constriction of the flow cross-section is obtained in the transition zone of the auxiliary flow channel into the main flow channel. Such a constricting point can also be constructed in the fashion of a venturi nozzle. Instead of a single intake opening, a plurality of especially two intake openings can be provided in each auxiliary flow channel. The sum of the opening cross-sections of the two or more intake openings should nevertheless be smaller than the flow cross-section in the remaining auxiliary flow channel.

The capsule wall sections of the first capsule part and the capsule wall sections of the second capsule part are preferably arranged so that they overlap. As a result of the overlapping, guidance is provided between the first and second capsule part during assembly so that the two capsule parts can be mounted simply and rapidly in the correct position. The overlapping regions of the two capsule parts also form a labyrinth-like gap seal so that a certain sealing effect is already achieved without needing to apply a separate sealing means.

However, a seal can be arranged between the overlapping capsule wall sections. Similarly, an upper edge of a housing part of the blower housing moulded on the lower shell can form a seal arrangement with a lower edge of a blower housing cover. In the seal arrangement can be a labyrinth seal, a sealing lip formed on one of the edges or a sealing cord which is inserted in a groove formed on one of the edges.

In addition to the embodiments described so far, as required additional components of the vacuum cleaners can be co-formed on a part of the insulating capsule or the blower housing. Thus, for example, a receptacle for the exhaust air filter, a holder for a cable drum, a cable running zone or a receptacle for a spindle

of a slide control can be moulded directly on a housing part, especially on the blower cover. Fibre-containing damping inserts can preferably be inserted as additional damping means at each point of the flow channel.

A preferred exemplary embodiment of a vacuum cleaner according to the invention is explained in detail in Figures 1 to 5.

In the figures:

Figure 1 is a perspective view of a lower shell of a vacuum cleaner according to the invention;

Figure 2 is a plan view of the lower shell from Figure 1;

Figure 3 is a cross-section through a vacuum cleaner according to the invention comprising an lower shell according to Figures 1 and 2;

Figure 4 is a perspective view of a blower compartment cover according to the invention;

Figure 5 is a cross-section through the longitudinal axis of a vacuum cleaner according to the invention.

An exemplary embodiment of a vacuum cleaner according to the invention comprises a housing 1 whose lower shell 2 is shown in Figure 1. The lower shell 2 is constructed as tray-like comprising a base area 3 and a circumferential shell wall 4. The shell wall 4 extends substantially vertically upwards starting from an edge zone of the base area 3. At the front end of the lower shell 1 a handle 5 is moulded onto the lower shell 2 on the outside of the shell wall 4. A dividing wall 6 is arranged approximately in a central region between the front end 7 of the lower shell 2 and a rear end 8 of the lower shell 2 in the interior of the lower shell 2. The dividing wall 6 extends from a first side wall section 9 shown at the front left in Figure 1 as far as a second side wall section 10 of the shell wall 4 shown at the back right. The dividing wall 6 divides the lower shell 2 into a front dust collecting compartment 11 and a rear blower compartment 12. The dividing wall

6 has an inflow funnel 13 via which suction air is sucked into the blower compartment 12 from the dust collecting compartment 11.

In the blower compartment 12 a first capsule part 14 is moulded onto the lower shell 2. The first capsule part 14 is formed by wall sections 15a, 15b and 15c of the first capsule part 14, by a part of the dividing wall 6 and a base part 3a of the base area 3 enclosed by the wall sections 15a, 15b and 15c of the first capsule part 14. The rear wall section 15b has an open-edged recess which forms a first retaining section 16 for a first bearing element 17 shown in Figure 3. The lateral wall sections 15a and 15c each have an opening 18a and 18b which produce a flow connection between an interior space 19 and a channel section 20 of a flow channel 21. The channel section 20 and a part of the flow channel 21 are delimited laterally by the wall sections 15a, 15b and 15c of the first capsule part 14 and wall sections 22a, 22b and 22c of a blower unit compartment 22. The lateral wall sections 22a and 22c of a blower unit compartment 22 adjoin the rear wall sections 22b and extend forwards as far as the dividing wall 6 and form, in the lower shell 2, a shell-shaped closed blower unit compartment 22 by means of an airtight-sealing blower compartment cover described in detail in Figure 4. Moulded on the dividing wall 6 below a through opening 23 is a second retaining section 24 which forms a ledge 25 which projects into the blower compartment 12. The ledge 25 is half-shell-shaped and is constructed as open at the top. It extends along an annular line concentric to the through opening 23. A second bearing element 26 can be inserted in the ledge 25, which together with the first bearing element 17 receives a motor/blower unit 27 shown in Figure 2.

In Figure 2 the flow profile is shown by means of arrows P1 to P6. The motor/blower unit 27 is shown in its mounted position between the wall sections 15a, 15b and 15c in the lower shell 2. From the dust collecting compartment 11 air from which dust has been removed by means of a filter bag or a dust separator box (not shown) is extracted into the inflow funnel 13, as indicated by the arrows P1, from the front dust collecting compartment 11 shown on the right in Figure 2 into the rear blower compartment 12 shown on the left in Figure 2. The extracted air is guided via the through opening 23 through the dividing wall 6 and to the suction opening 28 of the motor/blower unit 27, as indicated by the arrow P2. The extracted air flows through the motor/blower unit 27 and emerges from the motor/blower unit 27 at a rear end, as indicated by the arrows P3 and enters into

an inner channel section 28. In the inner channel section 28 the air flows between the housing wall of the motor/blower unit 27 and the wall sections 15a and 15c of the first capsule part 14 towards the front to the openings 18a and 18b. Since the air flowing towards the front through the openings 18a and 18b has entered into the outer channel section 20 from the inner channel section 28, the direction of flow is reversed, as indicated by the arrows P4, and the air now flows from front to back in the outer channel section 20 towards the back. In the outer channel section 20 the air is deflected at a right angle, as indicated by the arrows P5, behind the wall section 15b of the first capsule part 14. The arrows P6 indicated in Figure 2 show that the air at the end of the outer channel section 20 is deflected behind the motor/blower unit 27 in a direction which emerges from the plane of the drawing of Figure 2 to be passed between a vertical wall section 29a of a second capsule part 30 and a wall 31 of a blower compartment cover 32, as shown in Figure 3.

Figure 3 shows a cross-section through a vacuum cleaner according to the invention comprising the lower shell 2 from Figures 1 and 2. The arrows P6 shown as coming out of the plane of the drawing in Figure 2 appear in Figure 3 as an upwardly directed arrow P6. The air flows upwards in the direction of the arrow P6 in a main flow channel 33 running between the wall sections 29a of the second capsule 30 and the wall 31 of the blower compartment cover 32. Behind the rear end of the motor/blower unit 27, the air is guided upwards inside the main flow channel 33 and at the upper end of the vertical wall section 29a is deflected into a horizontal flow direction. The main flow channel 33 then runs along a horizontal wall section 29a of the second capsule part 30 underneath the blower compartment cover 32 onto an inflow opening 34 under an exhaust filter 35. The exhaust filter 35 abuts against the inflow opening 34 with its leading surface. Residual particles still contained in the air flow can be separated at the exhaust filter 35. Behind the trailing surface of the exhaust filter 35, the purified air flow leaves the vacuum cleaner via a plurality of exhaust openings 36 which are constructed as exhaust grids comprising fins.

Moulded on the lower shell 2 which is manufactured as a one-piece plastic injection moulding, are the handle 5, the dividing wall 6 and the wall sections 15 of the first capsule part 14 and the wall sections 22 of the blower compartment 12. An upper shell 37 covers the blower compartment 12 and a cable compartment 38

for accommodating a cable drum 39 (shown in Figure 4). The upper outer contour of the vacuum cleaner is completed by a dust compartment cover 40 which is joined to the upper shell 37 and extends from a rear end 41 in the vicinity of the exhaust opening 36 to a front end 42. The front end 42 of the dust compartment cover 40 has a locking element 43 which fixes the pivotally mounted dust compartment cover 40 in a closed position by means of a counter-locating element 44 on the lower shell 2. A cover wall 45 moulded on the dust compartment cover 40, which encircles the dust collecting compartment 11, projects into a groove 46 encircling the dust collecting compartment 11 into which a sealing cord 47 is inserted. The groove 46 is moulded on an upper end of a dust compartment wall 48 which is moulded on the bottom shell 2 and which encircles the dust collecting compartment 11. Located in the dust compartment cover 40 is an opening for dust-laden air 49 to which a suction hose connecting piece not shown can be connected. An outwardly open recess 50 is formed on the dust compartment cover 40 to accommodate accessories 54a, 54b such as crevice nozzles, upholstery nozzles, furniture brush or instructions for use or information sheets. The outwardly open recess 50 is covered by an accessory cover 52 mounted on the dust compartment cover 40 by means of a pivot bearing 51. A holding pallet 53 for fixing the accessories 54a, 54b in the correct position can be removably inserted in the recess 51, said pallet being preferably made from a flat thermoplastic sheet and moulded into a three-dimensional structure by blow moulding.

Figure 4 shows a perspective view of a blower compartment cover 32 according to the invention. The blower compartment cover 32 is constructed as an approximately rectangular shell body. Perpendicularly adjacent to an upper cover wall 55 is a first side wall section 56 shown on the right in Figure 4 and a second side wall section 57 shown on the left in Figure 4 and a rear wall section 58. The first side wall section 56, the second side wall section 57 and the rear wall section 58 are joined to one another at their side edges to form a U-shaped side wall 59 of the blower compartment cover 32. An inflow opening 34 is integrated in the cover wall 55. The front wall section 29d of the second capsule part 30 is moulded on one end of the cover wall 55 shown at the front in Figure 4 by means of a connecting web 59. The front wall section 29d of the second capsule part 30 is laterally connected to the first wall section 56 and the second wall section 57 of the blower compartment cover 32. The front wall section 29d is hemispherical-

disk-shaped and has a hemispherical open-edged recess 60 to receive the second bearing element 26 of the motor/blower unit 27. Opposite to the front wall section 29d the rear vertical wall section 29a of the second capsule part 30 is moulded onto the blower compartment cover 32. The main flow channel 33 runs in the direction of the inflow opening 34 in the cover wall 55 between the rear vertical wall section 29a of the second capsule part 30 and the rear wall section 58 of the blower compartment cover 32. Two vertical side wall sections 29b and 29c are moulded onto the blower compartment cover 32 between the wall sections 29a and 29d. A first auxiliary channel 61a runs between the side wall section 29c and the first side wall section 56. A second auxiliary channel 61b runs between the side wall section 29b and the second side wall section 57.

Figure 5 shows the first auxiliary channel 61a and the second auxiliary channel 61b in a cross-section through the longitudinal axis of the vacuum cleaner according to the invention. The lower shell 2 with the moulded-on wall sections 22a and 22c of the blower compartment 12 is shown. Inside the blower compartment 12 the wall sections 15a and 15c of the first capsule part 14 are moulded onto the base area 3. The first auxiliary channel 61a is defined by the wall section 22a and the wall section 15a. As is indicated by the arrows P8, a first auxiliary air flow flows upwards in the auxiliary channel 61a, between the wall section 29a and the first side wall section 56 of the blower compartment cover 32 and a second auxiliary air flow flows upwards in the auxiliary channel 61b between the wall section 29b and the second side wall section 57 of the blower compartment cover 32. A groove-shaped sealing arrangement 63 is moulded on a lower edge 62 of the side wall sections 56 and 57 and of the rear wall section 58 (not shown). An upper circumferential edge 64 of the wall sections 22a, 22b and 22c engages in the groove. Alternatively, a sealing cord not shown can be inserted in the groove. The sealing arrangement 63 seals a parting line between the blower compartment cover 32 and the blower compartment 12. Another sealing arrangement 65 is provided between the first capsule part 14 and the second capsule part 30. The sealing arrangement is constructed as a labyrinth seal. For this purpose the wall sections 15a, 15b and 15c of the first capsule part 14 partly overlap the wall sections 29a, 29b and 29c of the second capsule part 30.

The perpendicularly upwardly flowing auxiliary air flows enter into the main flow channel 33 via inflow openings 66 along the arrows P8. In this case, as is

indicated by the arrows P9, the auxiliary air flows impinge perpendicularly upon the main air flows P7, as is indicated by the arrows P9. The arrow P7 shown as running from left to right in Figure 3 appears in Figure 5 as arrows P7 emerging from the plane of the drawing. As a result of the perpendicular impingement of the auxiliary air flows P9 and the main air flows P7, the air becomes turbulent and enter into the inflow opening 34 as a diffuse flow as indicated by the arrows P10. Above the inflow opening 34 the exhaust filter 35 is inserted in a holder 67 (Figure 4) moulded onto the blower compartment cover 32. The holder has a circumferential marginal shoulder 68 on which a seal 69 is moulded on which the exhaust filter 35 rests forming a seal. As shown in Figure 4, not only the holder 67 but also a cable channel 70 is moulded on the blower compartment cover 32.